

**069513 - DEPT**

- word sign

-5. A computerized method as in Claim 1 wherein said receiving of user generated alphabetic signals includes receiving alphabetic signals representing alphabetic characters of either upper or lower case.

-6. A computerized method as in Claim 5:

- wherein said receiving of user generated alphabetic signals includes receiving in association with a given individual word signal a succession of one or more such signals each representing a characters which can be of either upper or lower case; and

- said method further including:

- storing a representation of the sequence of one or more characters represented by said succession of alphabetic signals, including the respective case of each such characters;
- responding to certain conditions by producing as an output for the given word signal the spelling associated with one of said vocabulary word selected as most probably corresponding to a word signal; and
- responding to certain other conditions by producing as an output for the given word signal said stored sequence of characters, including their respective case.

-7. A computerized method as in Claim 5 wherein said responding to the receipt of a given alphabetic signal by increasing the probability of selecting a vocabulary word having an associated spelling containing the alphabetic character represented by said given alphabetic signal includes:

- selecting said vocabulary word from a class of words having said alphabetic character in either upper or lower case when said given alphabetic signal represents a lower case character; and
- selecting said vocabulary word from a class of words having said alphabetic character only in the upper case when said given alphabetic signal represents an upper case character.

-8. A computerized method as in Claim 1 wherein:

- said receiving of user generated alphabetic signals includes receiving a succession of one or more such signals, representing characters of either case, in association with a given individual word signal; and

- said pattern matching includes:

- performing said pattern matching to select an alternate choice group of one or more vocabulary words which most probably correspond to said given word signal; and
- substantially limiting the words selected for the alternate choice group for said given word signal to words whose associated spellings start with the sequence of characters represented by said succession of alphabetic signals while not substantially limiting said selected words to words starting with the same sequence of cases as that of said sequence of characters.

-9. A computerized method as in Claim 8 further including:

-displaying said sequence of characters represented by the alphabetic signals, if any, received so far for the given word signal;

-displaying the words in said alternate choice group; and

-allowing a user to select one of the words in said alternate choice group.

-10. A computerized system for performing word recognition comprising:

-elements receiving user generated word signals representing words to be recognized;

-elements storing a plurality of vocabulary words, which store, for each such word, pattern information identifying word signals which represent that word and a spelling, the letters of which can be either upper or lower case;

-elements performing pattern matching between word signals and said pattern information to select which one or more of said vocabulary words most probably correspond to each such word signal;

-elements receiving a user generated string of one or more textual characters in association with an individual word signal; and

-filtering elements responding to the receipt of said user generated string by causing said pattern matching means to select said vocabulary word from a class of such words having an associated spelling each of which contains a string of textual characters related to those of said user generated string, wherein said filtering elements includes logic requiring that each such related string be similar to the user generated string in certain ways, but need not be similar to it in other ways.

-11. A computerized system as in Claim 10 wherein said logic require that the characters in each such related string corresponding to certain characters, if any, in said user generated string match the letters represented by said certain characters, but need not match the case of those characters.

-12. A computerized system as in Claim 11 wherein said logic requires that character sequence of each such related string match the letters, but not the case, of lower case characters in the user generated string, and match both the letters and case of upper case characters in the user generated string.

-13. A computerized system as in Claim 10 wherein said logic requires said related strings to correspond to the start of the spelling of their respective associated vocabulary word's pronunciation, and does not require said related strings to correspond to the start of said respective vocabulary word's spelling when said spelling includes characters before the start of the spelling of said pronunciation.

-14. A computerized method of training pattern information used by a word recognition system to identify the word signals which represent individual vocabulary words, said method comprising the steps of:

-storing a plurality of vocabulary words, including storing pattern information for identifying the word

signals which represent each such vocabulary word;

-prompting the user to generate a word signal representing a given vocabulary word;

-receiving a post-prompt word signal generated after the user was prompted to generate the prompted word;

-scoring the match of the post-prompt word signal against each word in an active vocabulary including one or more of said stored plurality of vocabulary words other than said prompted word;

-responding, when said scoring of the post-prompt word signal against one or more of said active vocabulary words other than said prompted word is better than a certain measure, by reducing the use of the post-prompt word signal to train pattern information associated with the prompted word; and

-responding, when said scoring of the post-prompt word signal against said active vocabulary words other than the prompted word which is worse than a certain measure, by increasing the use of the post-prompt word signal to train pattern information associated with the prompted word.

-15. A computerized method as in Claim 14 wherein:

-said storing of a plurality of vocabulary words includes storing a plurality of command vocabulary words, each of which has a function associated with it;

-said active vocabulary against which said word signal is scored includes one or more of said command vocabulary words; and

-said responding to said scoring which is better than a certain level includes responding to a score of said post-prompt word signal against one of said command vocabulary words which is better than a certain measure by causing the function associated with that command vocabulary word to be executed.

-16. A computerized method as in Claim 15 wherein:

-said receiving of a post-prompt word signal includes receiving an acoustic word signal representing the sound of a spoken utterance;

-said pattern information stored for each vocabulary word includes information relating to the sounds of that word's utterance; and

-said pattern matching is performed upon the post-prompt acoustic word signal.

-17. A computerized method as in Claim 15 further including the step of responding to input from a user indicating that a command vocabulary word is to be added to or removed from the active vocabulary against which the post-prompt word signal is scored by adding or removing that command vocabulary word from that active vocabulary.

-18. A computerized method as in Claim 15 further including the step of responding, when input from a user indicating that no commands are to be active during training, by preventing said scoring of the post-prompt word

signal against any command vocabulary word from

- causing the function associated with the command vocabulary word from being executed; and
- preventing the use of the post-prompt word signal to train pattern information associated with the prompted word.

-19. A computerized method as in Claim 15:

- wherein said prompting includes prompting the user to generate a word signal for a given command vocabulary word; and
- further including the step of preventing said scoring of the post-prompt word signal against the prompted command vocabulary word from:
  - causing the function associated with the command vocabulary word from being executed; and
  - stopping the use of the post-prompt word signal to train pattern information associated with the prompted command vocabulary word.

-20. A computerized method for training pattern information used by a word recognition system to identify which word signals generated by one or more users correspond to which words, said method comprising the steps of:

- prompting a user to generate a number of word signals representing a given word;
- scoring the match of one or more post-prompt word signals, that is, word signals generated after the user is prompted to generate the prompted word, against pattern information associated with the prompted word to produce a score for each such match;
- controlling the number of word signals the user is prompted to generate for the prompted word as a function of the scores produced by said scoring; and
- incorporating information from the prompted word's post-prompt word signals into pattern information associated with the prompted word.

-21. A computerized method as in Claim 20, wherein

- said pattern information against which each post-prompt word signals is scored includes information derived from the other post-prompt word signals, so said scoring scores the closeness of the match of said post-prompt word signals against each other; and
- said controlling of the number of word signal the user is prompted to generate includes responding, when said scoring indicates that post-prompt word signals do not match well against each other, by increasing the number of such word signals the user is prompted to generate.

-22. A computerized method as in Claim 20, wherein

-said scoring scores the match of said post-prompt word signals against pattern information, existing prior to the generation of said post-prompt word signals, for identifying which word signals correspond to the prompted word; and

-said controlling of the number of word signal the user is prompted to generate includes responding, when said scoring indicates that post-prompt word signals do not score well against said prior pattern information, by increasing the number of word signals the user is prompted to generate.

-23. A computerized word recognition system comprising:

-means for receiving user generated word signals representing words to be recognized;

-means for storing a plurality of vocabulary words, including storing for each such word pattern information for identifying word signals which represent that word;

-recognition means for performing pattern matching between word signals and said pattern information to produce scores indicating the relative probabilities that a given word signal corresponds to different ones of said vocabulary words; and

-means for training the pattern information associated with vocabulary words to better represent the word signals generated for their respective words under given circumstances, including:

--means for repeatedly prompting a user to generate a word signal representing a vocabulary word whose associated pattern information is to be trained;

--means for causing the recognition means to pattern match each post-prompt word signal, that is, each word signal generated after a user has been prompted to generate a word signal for the prompted word, against prior pattern information associated with the prompted word and to produce a score for each such match;

--repeat control means for causing the means for repeatedly prompting to stop repeatedly prompting the user to generate a word signal of the prompted word once a scoring requirement has been met, that is, once one or more post-prompt word signals received for the prompted word have scored better than a certain measure against the pattern information for the prompted word; and

--means for incorporating information from the post-prompt word for the prompted word into the pattern information associated with the prompted word.

-24. A computerized word recognition system as in Claim 23 wherein:

-said means for receiving user generated word signals receives acoustic word signals representing the sounds of spoken words;

-said pattern information stored for each vocabulary word includes information relating to the sounds of that word's utterance;

-said recognition means performs pattern matching upon such acoustic word signals: and



models of vocabulary words whose spellings correspond to words in the spelling of said phrase;  
and

- storing said acoustic model and spelling for said new vocabulary word;
- receiving acoustic word signals representing the sound of spoken words; and
- pattern matching the word signals against the word models of stored vocabulary words, including said new vocabulary word, to produce scores indicating the relative probability that a given word signal corresponds to different ones of said stored word models.

-32. A computerized method as in Claim 31 wherein said creating of a new acoustic model includes altering the acoustic models of the individual words concatenated to represent the coarticulation between the speech sounds of those word models which takes place when their associated words are spoken as part of one continuous utterance.

-33. A computerized method as in Claim 32 wherein:

- each of said acoustic word models represents a sequence of phonemes;
- said storing of acoustic word models includes:
  - storing phoneme-in-context models, each of which models the sequence of sounds associated with a given phoneme when it occurs in the context of an immediately preceding phoneme, if any, and an immediately following phoneme, if any; and
  - associating with each phoneme in each of said word models the phoneme-in-context model which describes that phoneme in the context of any immediately adjacent phonemes in which it occurs in that word model; and
- said altering of the acoustic models to represent coarticulation includes causing the phoneme-in-context models associated with phonemes immediately adjacent the boundary between concatenated word models in said new acoustic model to be the phoneme-in-context models which describe those phonemes in the context of the immediately adjacent phoneme on the other side of said word boundary.

-34. A computerized method as in Claim 31 wherein said pattern matching is discrete utterance speech recognition.

-35. A computerized method as in Claim 31 wherein said receiving of the spelling of a phrase includes enabling a user to generate a computer readable input representing a user selected succession of words, and receiving that input as the spelling of said phrase.

-36. A computerized method as in Claim 31 wherein:

- said computerized method is designed to be executed on a computer system capable of running a plurality of separate computer programs at one time; and





-42. A word recognition system as in Claim 41:

- wherein said other-program-monitoring means initiates the transfer to said word recognition system of command information which associates with one or more of said commands a command input which, when supplied to the other program, causes that other program to execute the command input's associated command; and
- further including means for responding to the selection by said recognition means of a word corresponding to a given one of said commands by causing the command input associated with that given command to be supplied to said other program, so as to cause that other program to execute the given command.

-43. A word recognition system as in Claim 41:

- further including means for storing a spelling associated with each of a plurality of said vocabulary words;
- wherein said command information includes spellings which the other program associates with individual active commands; and
- said probability-altering means increases the probability that vocabulary words whose spelling corresponds to that of such an active command will be selected by the recognition means.

-44. A word recognition system as in Claim 38:

- wherein said system is designed to operate on a computer system which can selectively give one of the program running on said computer an input focus, that is, the ability to receive certain user input; and
- further including:
  - focus-monitoring means for obtaining an indication of which other program, if any, running on said computer system currently has said focus; and
  - means responsive to the focus-monitoring means for causing said program-monitoring means and said probability-altering means to increase the probability that vocabulary words corresponding to information received from the program having the focus will be selected as most probably corresponding to a received word signal.

-45. A word recognition system as in Claim 38 wherein:

- said other-program-monitoring means initiates the transfer of information indicating the textual context of a cursor, that is a location at which input is entered into a body of text, in another program; and
- said probability altering means includes a language model means which alters the probability of which vocabulary word will be selected as a function of the information received indicating the textual context of the cursor in said other program.

46. A computerized method of performing word recognition designed to operate on a computer system which can run multiple program units at one time and which can selectively give one of those program units an input focus, that is, the ability to receive certain user input, said computerized method comprising the steps of:

- receiving user generated word signals representing words to be recognized;
- storing a plurality of vocabulary words, and storing a plurality of vocabulary states with which one or more vocabulary words can be associated;
- enabling a user to selectively add one or more vocabulary words to a vocabulary state;
- defining a set of one or more vocabulary states which are active at a given time;
- associating each of one or more of said vocabulary states with a corresponding ones of said program unit;
- performing pattern matching upon the word signals to select which one or more of a plurality of vocabulary words associated with the set of currently active vocabulary states most probably correspond to each such word signal;
- determining which program unit, if any, running on said computer system currently has said focus; and
- determining whether or not the program unit having the focus has a vocabulary state associated with it, and if so adding that vocabulary state to the set of active vocabulary states, and if not creating a new vocabulary state and associating it with the program unit which has the focus.

47. A computerized method as in Claim 46 wherein:

- said receiving of user generated word signals includes receiving acoustic word signals representing the sounds of spoken words; and
- said pattern matching performs speech recognition upon such acoustic word signals.

48. A computerized method as in Claim 46 wherein said program units which are determined to have the focus include application programs.

49. A computerized method as in Claim 46 wherein said program units which are determined to have the focus include programming associated with dialog boxes within application programs.

50. A computerized method as in Claim 46 further including the step of determining whether or not to stop storing a vocabulary state created for a program unit which has had the focus as a function of whether or not the user has added a vocabulary word to that state.

51. A computerized method of performing word recognition comprising the steps of:

- receiving user generated word signals representing words to be recognized;

- performing pattern matching upon the word signals to select which one or more of a plurality of vocabulary words most probably corresponds to each such word signal
- producing an output, at a movable cursor position in a body of text, corresponding to the one or more vocabulary words selected by said pattern matching for each of said word signals;
- finding one or more items in said body of text adjacent to said cursor position and using them to define a current language context; and
- varying the probability of which one or more words will be selected by said pattern matching as most probably corresponding to a given word signals as a function of said current language context;

-52. A computerized method as in Claim 51 wherein:

- said word signals are acoustic signals representing the sound of spoken words; and
- said pattern matching performs speech recognition on said acoustic word signals.

-53. A computerized method as in Claim 51 wherein:

- said method is executed on a computer system capable of running a plurality of active computer programs at one time;
- said step of producing an output includes supplying the spelling of vocabulary words selected by said pattern matching to another program running on said computer system for insertion at a cursor position into a body of text represented by that other program; and
- said step of finding adjacent items in said body of text includes obtaining such information from data structures created by said other program.

-54. A word recognition program designed to run different computer system having different computational resources available for use by said program, said program including:

- means for receiving user generated word signals representing words to be recognized;
- recognition means for performing pattern matching upon the word signals to select which one or more of a plurality of vocabulary words most probably correspond each such word signal;
- means for automatically detecting if certain computational resources are available for use by said program; and
- means for varying the computer instructions executed by said program in response to whether or not said means for detecting detects such resources are available to the program.

-55. A word recognition program as in Claim 54 wherein;

- said word recognition program is a speech recognition program;
- said means for receiving user generated word signals includes means for receiving acoustic signals representing spoken words; and

-said recognition means perform speech recognition upon said acoustic signals.

-56. A speech recognition program as in Claim 55 wherein:

-said recognition means including signal processing means for performing signal processing upon said received acoustic signals to produce processed representations of said received acoustic signals which are used in said pattern matching; and

-wherein said means for varying computer instructions includes means for causing said signal processing means to execute instructions which cause said signal processing to be either more or less computationally intensive, respectively, in response to a detection that said certain computational resources are or are not available.

-57. A speech recognition program as in Claim 56:

-further including means for storing word models in association with said vocabulary words, each of which represents the processed representations of acoustic signals associated with its associated vocabulary word;

-wherein said recognition means includes means for comparing said processed representations of acoustic signals with said word models to perform said pattern matching; and

-said means for comparing compares the processed representations produced by both said more and less computationally intensive signal processing against the same word models.

-58. A speech recognition program as in Claim 57 wherein:

-said less computationally intensive signal processing includes repeatedly performing FFTs upon said acoustic signal at a first frequency to produce a set of spectral energies at different frequencies once during each first frequency period; and

-said more computationally intensive signal processing includes repeatedly performing FFTs upon said acoustic signal at a second frequency which is a given multiple of said first frequency and then averaging the results of the FFTs during each first frequency period to produce a set of spectral energies once during each such first frequency period which corresponds in form to that produced by said less intensive signal processing.

-59. A speech recognition program as in Claim 56 wherein:

-said speech recognition program is designed to run at least in part on one or more central processing units, or CPUs; and

-said means for automatically detecting includes means for detecting if said computer system includes a certain type of digital signal processor, or DSP, available for use by said program.



-confirmation means, responsive to a detection both that said speech response means is in said off state and that no indication is stored that the off state has been confirmed by the user, for performing the following confirmation process:

- prompting the user to utter a phrase of one or more words confirming whether or not the user wants said speech response means to be in the off state;
- causing said on-off means to set said speech response means to an on state so it can respond to an utterance the user makes in response to said prompt;
- determining whether to leave said speech response means in said on or off state in response to the vocabulary word selected by the recognition means as corresponding to an acoustic signal received after said prompt; and
- responding to such a determination to leave said speech response means off, by causing said on-off means to set said speech response means to said off state and by storing an indication that the off state has been confirmed by the user.

-63. A computerized speech recognition system as in Claim 62:

- further including means for executing a user written sequence of programmed instructions;
- said on-off means includes means for setting said speech response means to either said off and on states in response to different instructions which can be included in said sequence of programmed instructions; and
- said confirmation means includes means for delaying the initiation of the confirmation process until after said system is done executing such a sequence of programmed instructions.

-64. A computerized method for performing word recognition comprising the steps of:

- receiving user generated word signals representing words;
- storing a plurality of vocabulary words, including storing, for each such word, pattern information identifying word signals which represent that word, and including storing at least a first and second set of such pattern information for each of a plurality of such vocabulary words;
- performing word recognition upon received word signals by pattern matching them against pattern information, including said first or second sets of pattern information, for each of a plurality of said vocabulary words in an active vocabulary to produce scores indicating the relative likelihood that each of said plurality of words corresponds to given word signal;
- providing a user interface specifically designed to enable a user to both select a given vocabulary word and to generate a command to stop using the second set of pattern information, if any, associated with that selected vocabulary word in said recognition step; and
- responding to the generation of such a model-changing command for said selected vocabulary word by causing the second set of pattern information associated with that selected vocabulary word, if any, to be

substantially ignored in said recognition step and for causing said selected word's first set of pattern information, if any, to be used by said recognition step instead.

-65. A computerized method as in Claim 64 wherein:

- said receiving of user generated word signals includes receiving acoustic word signals representing the sounds of spoken words; and
- said recognition is a speech recognition.

-66. A computerized method as in Claim 64 wherein said step of providing a user interface specifically designed to enable a user to both select a given vocabulary word and to generate said model-changing command includes projecting a menu item or control window on a computer screen and generating said model-changing command when the user selects said menu item or control window.

-67. A computerized method as in Claim 64:

- wherein said first set of pattern information which may be stored for a given vocabulary word is a spelled word model, which has a spelling formed of a sequence of word component, that is, a signal pattern which occurs as part of the word signals of more than one word, each of which has corresponding pattern information representing its signal in multiple words; and
- wherein said second set of pattern information which may be stored for a given word is a custom word model, which is defined by training data derived almost exclusively from word signals associated with its vocabulary word.

68. A computerized method as in Claim 67 further including the steps of using one or more given word signals which have been associated with a given vocabulary word, to train a word model associated with the given vocabulary words by performing the steps of:

- scoring the match between each of the given word signals against the word component pattern information defined by the spelled word model for the given vocabulary word; and
- responding to such a scoring between said word signals said spelled word models which is worse than a certain measure by using information in said given word signals to create and train a custom word model for said given vocabulary word and for causing that custom model to be used in subsequent word recognition when said given vocabulary word is in said active vocabulary;

-69. A computerized method as in Claim 67 further including the steps of:

- adaptively training the pattern information in the word components of a given vocabulary word by combining information from parts of a word signal of the given vocabulary word with pattern information for the corresponding word components in the spelled word model for the given vocabulary word, with the



weight being given to information from the word signal relative to prior word component pattern information in each such combination decreasing as a function of increases in the amount of prior training the word component pattern information has received; and

- responding to the generation of said model-changing command for a selected vocabulary word by increasing, in subsequent adaptive training for word components in the spelled word model of the selected vocabulary word, the weight given to information from word signals relative to pattern information previously associated with such word components.

-70. A computerized word recognition system comprising:

- means for receiving user generated word signals representing words;
- means for defining a plurality of vocabulary words, including means for defining a plurality of word model sets, each of which defines a word model for each of said vocabulary words;
- recognition means for pattern matching a word signal against a plurality of said word models to produce a score for each such word model indicating the relative likelihood that said word model corresponds to said word signal; and
- word model set selection means including:
  - set scoring means for causing said recognition means to pattern match each of one or more word signals against word models for one or more of said vocabulary words from each of said plurality of word model sets;
  - set selecting means for selecting a word model set whose one or more word models have the best score against said one or more word signals; and
  - set favoring means for increasing the likelihood that said recognition means will expend more computational resources performing pattern matching against said selected word model set than against any other word model set.

-71. A computerized word recognition system as in Claim 70 wherein said set scoring means includes means for producing a relative score of a word signal against each of said word model from a different model set for a given vocabulary word indicating the relative likelihood that each such word model corresponds to said word signals.

-72. A computerized word recognition system as in Claim 71 wherein said set scoring means includes means for causing said recognition means to performs its pattern matching of a given word signal against said word models from said different model sets as part of one recognition process.

-73. A computerized word recognition system as in Claim 71 wherein:

- said word signals are acoustic signals of a person uttering a spoken word;
- each of said word models is an acoustic word model which represents the acoustic word signals

associated with utterances of a given word; and  
-said recognition means is a speech recognition means.

-74. A computerized word recognition system as in Claim 73 wherein said different word model sets are designed to represent how different types of speakers speak said vocabulary words.

-75. A computerized word recognition system as in Claim 71 wherein:

- said set scoring means includes means for causing said recognition means to pattern match each of a plurality of word signals against word models for each of a corresponding plurality of said vocabulary words from each of said plurality of word model sets; and
- said set selecting means selects the word model set whose word models for a plurality of said vocabulary words have the best score against said plurality of word signals.

-76. A computerized word recognition system as in Claim 75 wherein said set scoring means includes means for successively prompting the user to generate each of a plurality of vocabulary words and for pattern matching the word signals generated in response to each such prompt against word models from each word model set for the prompted vocabulary word.

-77. A computerized word recognition system as in Claim 71 wherein said set favoring means includes means for causing said recognition means to perform substantially no pattern matching against word models from any of said word model sets other than said selected word model set.

-78. A computerized word recognition system as in Claim 71 wherein said means for defining a plurality of word model sets includes:

- means for associating with each of said vocabulary words a spelling of shared word component symbols, each of which symbols represents a shared word component, that is, a signal pattern which occurs as part of the word signals of more than one word; and
- means for associating with each of said word model sets a corresponding shared component model set, each of which shared component model sets includes a shared component model for each symbol used in said spellings, which represents the signal patterns associated with its associated shared word component.

-79. A computerized word recognition system as in Claim 78 wherein:

- said recognition means includes means for defining all spelled word models, that is all word models defined by spellings of shared word component symbols, used by the recognizer in a match against a given word signal by interpreting the shared word component symbols of those word models by reference to a single active word component model set;

-said set scoring means includes:

--means for causing said recognition means to perform said pattern matching against said non-spelled models for purposes of producing said relative scores.

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